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Acidizing the Irrigation Well

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Acidizing the Irrigation Well

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This publication supplements Fact Sheet 195, "Operating and Maintaining Irrigation Wells." Experiments and field tests have shown that incrusted wells *(metal constructed)* can be successfully treated with sulfamic acid at moderate cost and without hiring specialized labor.

The topics discussed will be as follows:

- What Well Incrustration Is
- Preventative Maintenance
- Symptoms of a "Sick" Well
- Treatment Timeliness
- Repeated Treatment
- Treatment Limitations
- Chemicals Available for Treatment
- Equipment Needed
- Acidizing Procedure

WELL INCRUSTATION

Well incrustation can be seen as a cement—water and/or bacteria provide the cementing agent and acquifer sand provides the aggregate. Formation of this hard or gummy material on the outside of the well screen prevents water from flowing through the screen slots. The formation may even occur in the acquifer immediately surrounding the screen. Do not confuse incrustation with the various forms of corrosion. Corrosion is the deterioration or eating away of the well construction material(s).

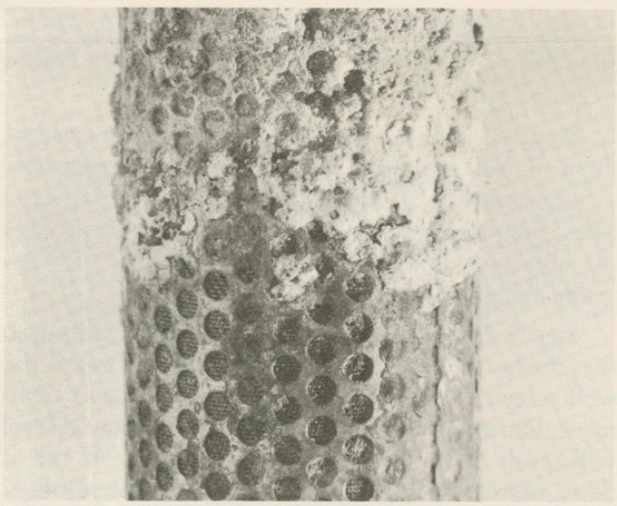

Figure 1. Incrustation on well sand point. The lower half was treated with sulfamic acid.

Table 1. A Typical Analysis of Precipitate Causing Well Incrustation

Calcium Carbonate	15.0%
Organic Material	0.5%
Silica	59.0%
Iron Oxide	7.0%
Aluminum Oxide	0.5%

PREVENTATIVE MAINTENANCE

The exact causes and prevention of incrustation are unknown. Incrustation of the gummy type (usually iron bacteria buildup) can be controlled by a twice-a-year chlorination of the well. (See Fact Sheet 195.) However, the harder type of incrustation (caused by minerals) may or may not be preventable. Complications arise when both types of incrustation occur at the same time. Well screen manufacturers contend that many cases of incrustation on screens are a direct result of excessively high water velocities through the screen slots. *Periodic chlorination* of wells and the *proper design* of the well can do much to deter incrustation. **Complete prevention of incrustation cannot be guaranteed.**

SYMPTOMS OF A "SICK" WELL

A close check of an incrusted well will show that the static (or standing) water level in the well is about normal; however, the water level while pumping (or drawdown) is much lower than normal. Incrustation generally lowers the normal operating water level (increases drawdown) before the decrease in discharge is evident. By the time decreased discharge is noticeable (without actual measurement), incrustation is at an advanced stage. **For this reason, a continuous record of drawdown and discharge is needed to diagnose the well problem correctly.** A decrease in well discharge may also be brought about by power shortage, pump wear, etc. Well records will help detect these problems.

TREATMENT TIMELINESS

Begin treatment when well production has declined to about 80% of normal production. For example, a well which normally discharged 1000 gpm with 10 feet of drawdown for a specific capacity of 1000/10 or *100 gpm/foot of drawdown* now produces only 1000 gpm with 13 feet of drawdown for a specific capacity of 1000/13 or *77 gpm/foot of drawdown*. The need for treatment of this well is certain.

REPEATED TREATMENT

A metal constructed well can be acidized with sulfamic acid as many times as necessary to keep it in production. It is recommended that a well be acidized only when the treatment is definitely needed. Acidization with sulfamic acid provides no preventative maintenance.

NOTE: These recommendations apply only to irrigation wells constructed with metal screen and casing. **Do not treat concrete wells with the chemicals described in this fact sheet.**

TREATMENT LIMITATIONS

Laboratory experiments have shown that all metallic materials in good condition will withstand treatment for incrustation.

An old well with a known corroded casing would be subject to some risk of failure or collapse when treated. Weigh this factor when deciding whether or not to treat.

CHEMICALS AVAILABLE FOR TREATMENT

The three acids normally used to remove incrusting material are muriatic (hydrochloric) acid, hydroxyacetic acid, and sulfamic acid. Experience with irrigation wells in eastern South Dakota has shown that dry sulfamic acid is capable of removing both types of incrustation and can be handled by irrigators with caution. Muriatic acid, an active liquid acid, must be handled with more caution and is normally used by a well driller or someone with equipment to lift the pump from the well. Hydroxyacetic acid (liquid) is a slower acting acid than either sulfamc or muratic acid. Its success has not been measured.

Sulfamic Acid

HSO_3NH_2 describes sulfamic acid chemically. **Do not confuse sulfamic acid with sulfuric acid (H_2SO_4).** Sulfamic acid is commercially prepared and available as a 100% acid in either granular or crystalline form. It is white and has a pungent odor. Sulfamic acid presents no serious health hazards if precautions listed on the label are taken. Certain heavier-than-air gases are emitted as sulfamic acid reacts with salts and oxides of ordinary incrusting precipitates. Therefore, when this acid is handled inside a building, pit, or other confined area, provide forced ventilation.

Sulfamic acid will remove all known types of incrustation, but it does not necessarily kill bacteria. Chlorination is recommended for killing bacteria.

The cost of treating an irrigation well for incrustation with sulfamic acid will be from $70 to $90, depending on the length of screen and depth of water treated.

Sulfamic acid, along with inhibitor and wetting agent, can be obtained from an industrial chemical firm. Your local druggist can tell you who to contact.

EQUIPMENT NEEDED

1. Goggles and rubber gloves for acidizing crew (two men are adequate).
2. One- to 2-inch hose or tube long enough to reach top of well screen.
3. Acid, inhibitor, and wetting agent amounts as directed. (See Table 2.)
4. Scale to weigh ingredients.
5. Small scoop to handle acid.
6. Funnel.
7. Clean water supply.
8. Five gallon mixing bucket.
9. Power unit (to surge well).
10. Extra pipe for waste pumping.

ACIDIZING PROCEDURE

The procedure for acidizing a well with sulfamic acid:

Step 1. Check and record, by the best means available, the discharge and drawdown of the well before treating. This is for later comparison.

Step 2. Check the pump base for access in treating the well. You will need at least a 1-inch diameter hole to accommodate a plastic or rubber tube. In some cases, the pump can be shifted to the side to provide the necessary opening. Remember, the acid must go *inside the well screen.*

Step 3. Acquire enough plastic or rubber tubing so that the bottom end of the tube reaches the top of the well screen. The screened area needs the acid treatment. Dumping the acid into the well at ground level will result in an initially weaker solution. If this is done, more acid is needed to strengthen the solution. A short heavy chain, wired to the bottom end of the tube, will assure that the tube will drop straight into

the well without encircling the pump column. Fasten a funneling device to the upper end of the tube for ease of pouring the acid slurry into the tube. See Figure 2.

Step 4. Pour the acid through the tubing to the screen area in the amounts indicated in Table 2. The desired end-product is a 7-10% (by weight) solution of acid in the well water. Laboratory tests show that solutions as high as 15% will not corrode metal. Corrosive inhibitor and wetting agent (low detergent soap) are each added in an amount equal to 10% (by weight) of the acid. **Remember, handle the acid with care and provide additional ventilation when operating in a confined area.**

Table 2. Quantities of Sulfamic Acid, Corrosive Inhibitor, and Wetting Agent for Each 10 Feet of Well Screen.

Screen Diameter (Inches)	Lbs. Water Per 10 ft. Screen	Lbs. 100% Sulfamic Acid per 10 ft. Screen	Lbs. Corrosive Inhibitor per 10 ft. Screen	Lbs. Wetting Agent per 10 ft. Screen
4	55	6.0	0.6	0.6
6	123	12.0	1.2	1.2
10	341	34.0	3.4	3.4
14	668	67.0	6.7	6.7
18	1,100	110.0	11.0	11.0

A successful method of preparing the acid-inhibitor-wetting agent mixture is as follows: Use a 5-gallon bucket containing about 2 gallons of clean water. Add the ingredient mixture until a heavy but pourable slurry is produced. Pour this slurry into the tube.

Experience and size of tube will determine the time required to introduce the acid. There is no need to hurry the operation. A well can usually be treated in 1 to 2 hours.

Step 5. Allow the acid to be undisturbed in the well at least 1 hour after the last acid has been added. Then add an amount of water to the well that will force some of the acid mixture through the screen and into the acquifer. For example, 150 gallons of water in an 18-inch casing would equal a column of water 10 feet high. Smaller casings would require less water.

Step 6. After the head of water has been added, surge the well briskly. Surging is done by starting the pump, bringing the water up the pump column and then letting the water fall back down. Plug the pump discharge to prevent losing the acid mixture. Surging should be done about every 4 to 6 hours.

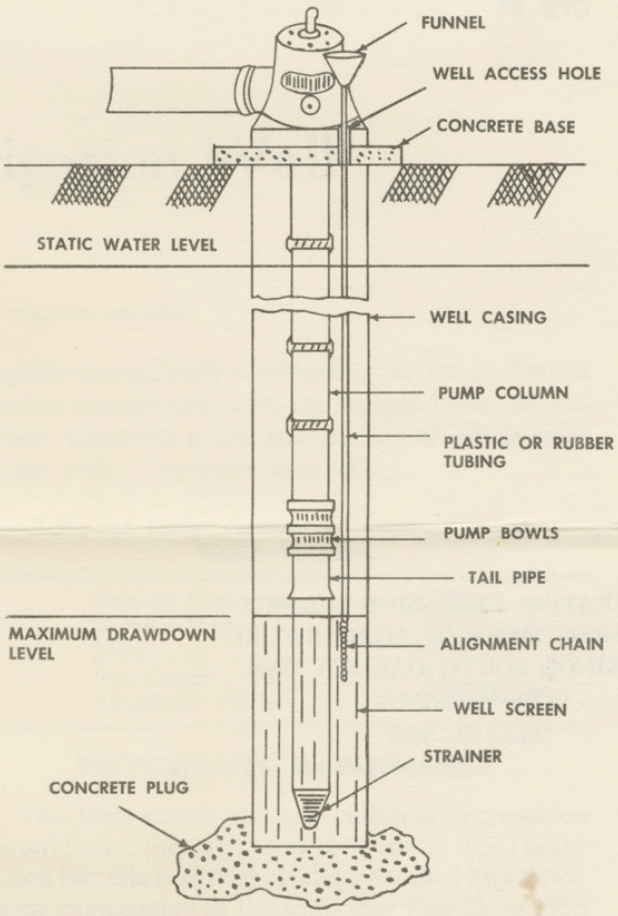

Figure 2. Irrigation well ready to be acidized with sulfamic acid.

Step 7. Sulfamic acid is quite active and, with surging, can usually accomplish its purpose in 16 to 24 hours.

Step 8. Provide for the waste water before pumping the acid mixture from the well. Keep this waste away from domestic wells, ponds, or other consumptive waters. The waste, when diluted, will not adversely affect plants. Pumping waste should be a process of brisk surging followed by slow pumping until the water has cleared to normal and is free of odor and foam.

Step 9. The well is now ready for testing and full use. Check the final discharge and drawdown for record and comparison.

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